Institutional Effectiveness Report
2020-21

Program: Engineering BS

College and Department: College of Engineering – General and Basic Engineering

Contact: Chris Wilson

Mission: The General & Basic Engineering (GBE) Department will provide a high quality educational experience for the students under its care through a flexible balance of academic, professional, and extracurricular programs. Additionally, the department will develop and maintain partnerships and service opportunities for its students, faculty, staff with the region and general public as a whole. Finally, the department will contribute to society through its engineering scholarship.

Program Goal:

In the first few years following graduation, the graduates of the BSE program will:

PG 1: Serve engineering needs in East Tennessee, Middle Tennessee, and broader markets, especially in companies which may have very few degreed engineers.

PG 2: Collaborate with non-engineers or discipline-specific engineers or both because of the general engineering background.

PG 3: Grow—Demonstrate career and professional growth as an engineer.

Student Learning Outcome:

The student outcomes are as follows:

SO 1: an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics;

SO 2: an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors;

SO 3: an ability to communicate effectively with a range of audiences;

SO 4: an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, considering the impact of engineering solutions in global, economic, environmental, and societal contexts;

SO 5: an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives;

SO 6: an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions;

SO 7: an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

A departmentally developed curriculum map can be found in Appendix 1 that shows the connections between courses and student learning outcomes.

Alignment of PEOs and SOs

	SO1	SO2	SO3	SO4	SO5	SO6	SO7
SO Topic	Complex problems	Engr design	Comm	Ethics and judgment	Team and project mngt	Exp and data analysis	New knowledge
PEO1: Serve	x	x	x	x		x	x
PEO2: Collaborate	x	x	x	x	x	x	x
PEO3: Grow	x		x	x	x		x

Assessment Methods:

1. *ENGR 4510 – Assignment (SO7):*
2. *ENGR 4900 – Report (SO3, 4):*
3. *ENGR 4950 – Project Report (SO1, 2, 4, 5, 7):*
4. *ENGR 4960 – Project Report (SO1, 2, 3, 5, 6, 7):*
5. *ME 2023 – Lab Report (SO1, 6):*
6. *Senior Exit Survey (SO1, 2, 3, 4, 5, 6, 7):*

The target is that 80% or more of the students meet or exceed expectations for each performance indicator. Any performance indicator in which more than 20% of students do not meet expectation will trigger a review, which may result in an action for program improvement.

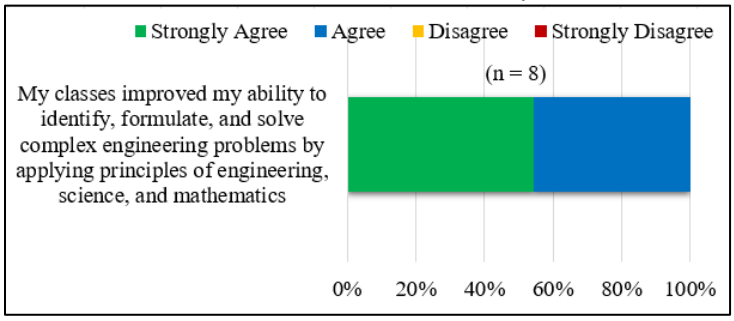
Results:

SO 1: an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics;

Direct Assessment Data: Complex Problems Rubric

	Performance Indicator	Does Not Meet	Meets	Exceeds
Identity	Demonstrates understanding of problem scenario by developing a well-written problem/opportunity statement	0%	100%	0%
	Identifies problem requirements through clear statement of constraints, criteria, variables, and objectives	0%	100%	0%
	Identifies appropriate modeling approaches related to the engineering system	0%	100%	0%
Formulate	Subdivides complex problems into smaller, more tractable problems	0%	100%	0%
	Simplifies complex problem into idealized model(s)	0%	100%	0%
	Develops appropriate math/science/engineering model	0%	33%	67%
	Identifies viable solution approaches	0%	100%	0%
	Makes reasonable assumptions for models and recognize limitations so that the appropriate one is selected for the context or application	0%	33%	67%
Solve	Selects and applies effective solution procedures/techniques/tools correctly	0%	100%	0%
	Solves math model using analytical, numerical, and/or approximate methods	0%	100%	0%
	Verifies that the solution is practical and can be implemented	0%	100%	0%
	Validates that the solution is appropriate and reasonably represents the original problem	0%	100%	0%

Indirect Assessment Data: Senior Exit Survey

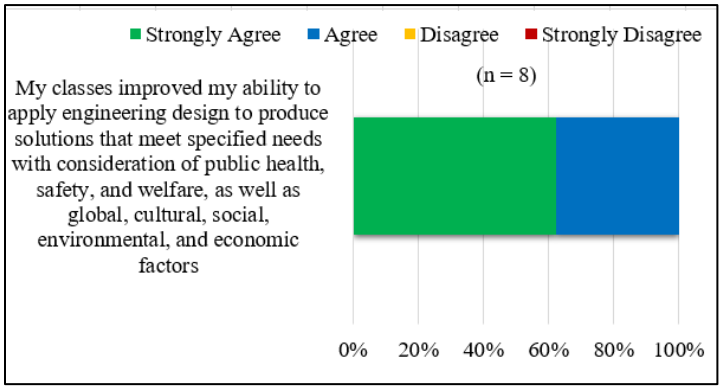


SO 2: an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors;

Direct Assessment Data: Engineering Design Rubric

	Performance Indicator	**Does Not Meet**	**Meets**	**Exceeds**
Design Considerations	Ask design questions with respect to health, safety, welfare factors	-	-	-
	Asks design questions with respect to global, cultural, social factors	0%	100%	0%
	Asks design questions with respect to environmental and economic factors	0%	100%	0%
	Asks design questions with respect to codes and standards	0%	100%	0%
	Identifies important design variables, documents specifications, establishes constraints, and considers implementation strategy to define solvable design space	0%	100%	0%
Design Process	Demonstrates application of the steps of the engineering design process	0%	100%	0%
	Develops clearly defined goals	0%	100%	0%
	Gathers information and performs analysis and synthesis	0%	100%	0%
	Includes steps of analysis, construction (if needed), testing, and evaluation as part of design project	0%	100%	0%
	Formulates and documents more than one variable design to meet specified needs	0%	100%	0%
Evaluation	Evaluates alternatives against requirements and considers risks and trade-offs	0%	100%	0%
	Analyzes and ranks design possibilities to find "best" solution with consideration to the interdependency of the constraints	0%	100%	0%
	Uses risk analysis to enumerate/respond to risks in product or process design. Considers solution alternatives with respect to health, safety, welfare factors	0%	100%	0%
	Considers solution alternatives with respect to health, safety, welfare factors	0%	100%	0%
	Considers solution alternatives with respect to global, cultural, social factors	0%	100%	0%
	Demonstrates use of design cycles more than once on a specified problem for refined result	0%	100%	0%
Design Solution and Documentation	Fully conveys selection of final design and documentation	0%	100%	0%

Indirect Assessment Data: Senior Exit Survey

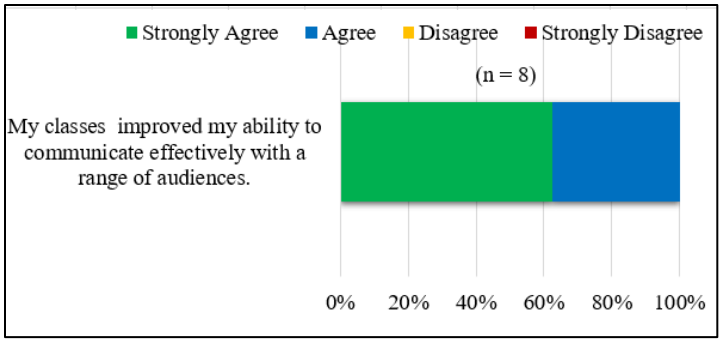


SO 3: an ability to communicate effectively with a range of audiences;

Direct Assessment Data: Oral Communication Rubric

	Performance Indicator	**Does Not Meet**	**Meets**	**Exceeds**
Delivery and Engagement	The student dresses appropriately for the presentation	0%	100%	0%
	The student speaks loudly enough to be heard	0%	100%	0%
	The student avoids "ums," "uhs," or other filler words and unnecessary movements	0%	100%	0%
	The student maintains eye contact with the audience	0%	100%	0%
	The student does not read from the presentation	0%	100%	0%
Technical Content	The presentation is well-organized	0%	100%	0%
	The length of the presentation is appropriate for the setting	0%	100%	0%
	The student demonstrates technical knowledge	0%	100%	0%
	The student addresses questions well	0%	100%	0%
	The student uses technical vocabulary appropriate for the audience	0%	100%	0%
Supporting Materials	Correct Spelling and grammar are used in the visual presentation	0%	100%	0%
	Appropriate props, such as physical models or prototypes are used to support the presentation	0%	100%	0%

Indirect Assessment Data: Senior Exit Survey

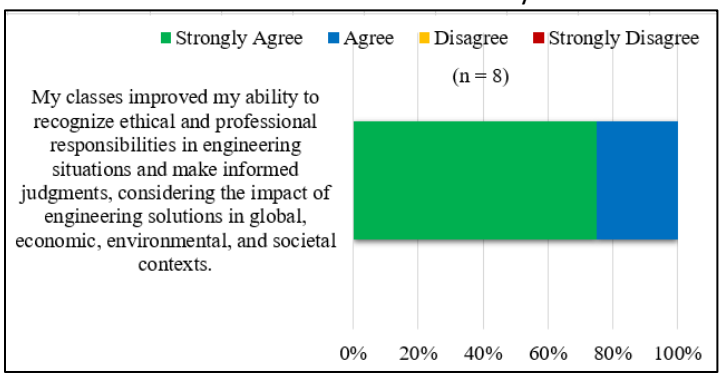

Strongly Agree
Agree
Disagree
Strongly Disagree
(n = 8)
My classes improved my ability to communicate effectively with a range of audiences.
0%
20%
40%
60%
80%
100%

SO 4: an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, considering the impact of engineering solutions in global, economic, environmental, and societal contexts;

Direct Assessment Data: Ethics Rubric

	Performance Indicator	Does Not Meet	Meets	Exceeds
Ethical Issue Recognition	Identifies key ethical issues in engineering situations taken from real life, with outcomes both good and bad	8%	92%	0%
	Identifies current or recent ethical cases and explains the main issues	0%	100%	0%
	Explains engineering responsibility for the public health, safety, and welfare as stated in a relevant engineering code of ethics	8%	92%	0%
	Understands conflict of interest and consequences of various actions	0%	100%	0%
Application of Ethical/Professional Perspectives and Contexts	Makes balanced engineering judgements i.e. selects alternatives and solutions, informed by appropriate codes, standards, breadth of information	0%	100%	0%
	Assesses the economic impact of a solution, considering issues such as job creation or elimination, disruption or lifestyle, culture	50%	50%	0%
	Assesses the societal impact of a solution, including identifying costs and benefits from a life-cycle perspective	50%	50%	0%
	Assesses the societal impact of a solution, considering issues such as waste generation and pollution, sustainability, life-cycle design with respect to materials and energy	0%	100%	0%
	Assesses the global impact of a solution, considering issues such as labor and material sources, laws and regulations, human rights, fair trade, geopolitical stability, culture, and language	0%	100%	0%
	Conducts an appropriate safety analysis i.e. considering hazards and safety concerns	33%	67%	0%

Indirect Assessment Data: Senior Exit Survey

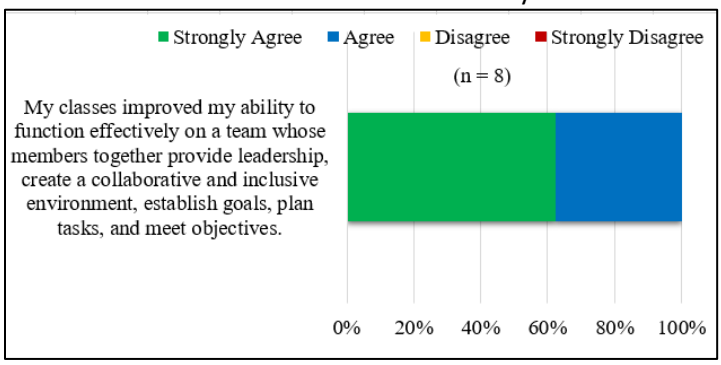


SO 5: an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives;

Direct Assessment Data: Teamwork Rubric

	Performance Indicator	Does Not Meet	Meets	Exceeds
Communication & Team Operation	Communicates effectively with team members	0%	100%	0%
	Attends regular scheduled team meetings	0%	100%	0%
	Engages and participates as a team member	0%	100%	0%
	Divides the workload fairly among the team	0%	100%	0%
	Defines roles for each team member	0%	100%	0%
	Works with team to define a decision-making process	0%	100%	0%
Project Management	Uses project planning/scheduling methodologies and tools to manage the project	0%	100%	0%
	Assigns and tracks project tasks and responsibilities	0%	100%	0%
	Documents team meetings (including discussions and attendance)	0%	100%	0%
	Maintains organized project documentation (electronically or project notebook)	0%	100%	0%

Indirect Assessment Data: Senior Exit Survey

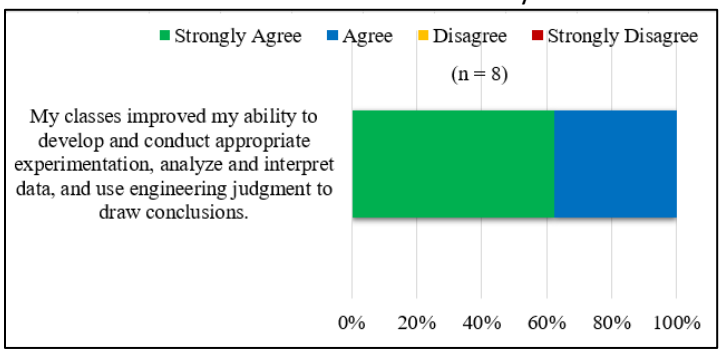


SO 6: an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions;

Direct Assessment Data: Experimentation Rubric

		Does Not Meet	Meets	Exceeds
Set-Up	Identifies appropriate test, data collection process, and data analysis model to conduct an experiment	0%	100%	0%
	Describes and uses general measurement process or processes appropriate for the experiment	0%	100%	0%
	References and uses appropriate standards for various test and experimental procedures	0%	100%	0%
	Develops hypotheses or predictions of experimental outcomes to validate modeling assumptions and correctness of experimental methods	0%	100%	0%
	Checks and/or calibrates the measurement system for appropriate calibration	0%	100%	0%
	Sets up the experiment to ensure proper lab practice, operation, and general safety	0%	100%	0%
	Uses dimensional analysis, appropriate dimensions, and units	0%	100%	0%
Data Collection	Troubleshoots measurement systems for non-functioning components	0%	100%	0%
	Uses appropriate instruments for collecting data	0%	100%	0%
	Implements proper lab practice, operation, and general safety	0%	100%	0%
	Maintains good technical notes of procedure and results	0%	100%	0%
	Uses appropriate equipment, software and/or tools for data collection	0%	100%	0%
Analysis	Uses appropriate statistical methods and measures to minimize experimental error	0%	100%	0%
	Identifies and quantifies sources of information or related data	0%	100%	0%
	Validates data using other sources of uncertainty in the date or analysis	0%	100%	0%
	Uses appropriate software and/or tools for analysis	0%	100%	0%
Summary and Conclusion	Develops and supports conclusions and inferences with available data and analysis	0%	100%	0%
	Compares experimental results to theoretical results and explains discrepancies	0%	100%	0%
	Documents in an appropriate form so that the experiment can be properly replicated	0%	100%	0%

Indirect Assessment Data: Senior Exit Survey

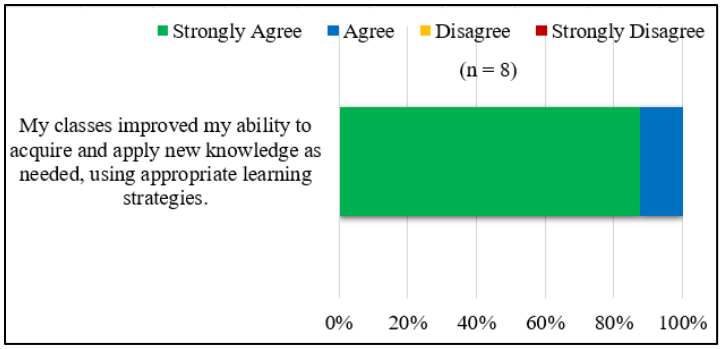


SO 7: an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Direct Assessment Data: Knowledge and Learning Strategies Rubric

	Performance Indicator	Does Not Meet	Meets	Exceeds
Self-established Learning Goals	Demonstrates analysis of prior learning for gaps in knowledge and skills	-	-	-
	Develops a plan to acquire new knowledge and skills	-	-	-
Acquiring New Information	Identifies the extent and type information needed for the problem or task at hand	17%	83%	0%
	Independently conducts critical searches for references (literature and/or subject matter experts) to support/inform a topic	-	100%	-
	Summarizes written/oral information for key concepts	8%	75%	17%
	Demonstrates the ability to assess the credibility and applicability of information sources	0%	92%	8%
Learning Strategies	Demonstrates awareness of different learning strategies	-	-	-
	Identifies personal strengths and weaknesses with respect to learning strategies	-	-	-
	Engages in professional learning experiences	0%	100%	0%
Applying New Information	Demonstrates ability to use newly acquired information to solve engineering problems or apply to other engineering situations	17%	67%	17%

Indirect Assessment Data: Senior Exit Survey



Modifications for Improvement:

SO 1: solve complex engineering problems

All targets were met. No improvement is recommended.

SO 2: ability to apply engineering design

For the missing performance indicator "Ask design questions with respect to health, safety, welfare factors", an assessment instrument will be designed in ENGR 4950 Senior Design I and will be implemented in Fall 2021.

SO 3: ability to communicate effectively

ENGR 4900 did not have graded activities for oral communication – just participatory discussions. An oral presentation activity will be developed in ENGR 4900 and it will be implemented in Fall 2021.

SO 4: ability to recognize ethical and professional responsibilities

During spring 2020 assessment period no assessment data for SO4 was collected due to lack of appropriate pedagogy/content. To remedy the lack of assessment data, faculty of ENGR 4900, ENGR 4950 and ENGR 4960 met and developed content and assessment instruments and implemented them during 2020-21 academic period. The new assessment tool is noted in the Assessment Methods (*ENGR 4900* – Report).

Since in several performance indicators, more than 20% students did not meet expectations, a review has been initiated. Faculty of ENGR 4900 and ENGR 4950 will meet and develop improvement measures. They will present their improvement activities to the AAC for approval and improvement activities will be implemented in the next course offerings.

SO 5: teamwork

All targets were met. No improvements have been recommended.

SO 6: appropriate experimentation

All targets were met. No improvements have been recommended.

SO 7: ability to acquire and apply new knowledge

Faculty of ENGR 4510, ENGR 4950 and ENGR 4960 will meet and review the rubric and its performance indicators. Improvement measures will be submitted to the AAC for review and approval. Approved improvement measures will be implemented in the next course offerings.

Appendices

1. Curriculum Map
2. Complex Project Rubric
3. Engineering Design Rubric
4. Oral Communication Rubric
5. Written Communication Rubric
6. Ethics Rubric
7. Teamwork Rubric
8. Experimentation Rubric
9. New Knowledge and Learning Strategies

Appendix 1: Curriculum Map

BSE Assessment Plan – Course Mapping

Student Outcome		SO1	SO2	SO3	SO4	SO5	SO6	SO7
Tenn. Tech Required Course (2020-21 Catalog)	**ETSU Required Course (2020-21 Catalog)**	**Complex Problems**	**Engineering Design**	**Communication**	**Ethics and Professionalism**	**Teamwork and Project Management**	**Experimentation and Data Analysis**	**New Knowledge and Learning Strategies**
CEE 2110 Statics	CEE 2110 Statics	I						
ME 2330 Dynamics	ME 2330 Dynamics							I
CEE 3110 Mechanics of Materials	CEE 3110 Mechanics of Materials							I
COMM 2025 Fund. of Communication	COMM 2025 Fund. of Public Speaking			I				
ECE 2850 Principles of Electric Circuits	ECE 2010 Electric Circuits I	I						
ECE 2851 Prin. of Electric Circuits Lab	ECE 2011 Electrical Engineering Lab			I			I	
ECE 3850 Int. Prin. of Electric Circuits	ECE 2020 Electric Circuits II	I						
ENGR 1110 Engineering Graphics	ENGR 1110 Engineering Graphics			I		I		I
ENGR 1120 Programming for Engineers	ENGR 1120 Programming for Engineers							I
ENGR 3020 Numerical Methods	CSC 3020 Numerical Methods	R						
ENGR 3120 Solid Modeling	ENGR 3120 Solid Modeling		I, R			R		
ENGR 3710 Prin. Of Engr. Economy	CEE 3710 Prin. Of Engineering Econ.		I		I			
ENGR 3720 Engineering Statistics	CEE 3720 Engineering Statistics				I		I, R	
ME 3010 Materials & Processes in Mfg.	ME 3010 Materials & Processes in Mfg.				R			I
ME 3023 Measurements in Mech. Sys.	ME 3023 Measurements in Mech. Sys.	**D**		R			**D**	
ENGR 4510 Engineering Management	ENGR 4510 Engineering Management			R		I,R		**D**
ENGR 4900 Engr. Design, Prof., & Ethics	ENGR 4900 Professionalism & Ethics	R	R	**D**	**D**	R		R
ENGR 4950 Senior Design I	ENGR 4950 Senior Design I	**D**	**D**	R	**D**	**D**	R	**D**
ENGR 4960 Senior Design II	ENGR 4960 Senior Design II	**D**	**D**	**D**		**D**	**D**	**D**

Legend: I: Introduce; R: Reinforce; D: Demonstrate

Appendix 2: Complex Project Rubric

SO1: An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

Complex Engineering Problems: Complex engineering problems include one or more of the following characteristics: involving wide-ranging or conflicting technical issues, having no obvious solution, addressing problems not encompassed by current standards and codes, involving diverse groups of stakeholders, including many component parts or sub-problems, involving multiple disciplines, or having significant consequences in a range of contexts.

Performance Dimensions	Does Not Meet Expectations	Meets Expectations	Exceeds Expectations
Identify			
Demonstrates understanding of problem scenario by developing a well-written problem/opportunity statement			
Identifies problem requirements through clear statement of constraints, criteria, variables, and objectives			
Identifies appropriate modeling approaches related to the engineering system			
Formulate			
Subdivides complex problems into smaller, more tractable problems			
Simplifies complex problem into idealized model(s)			
Develops appropriate math/science/engineering model			
Identifies viable solution approaches			
Makes reasonable assumptions for models and recognizes limitations so that the appropriate one is selected for the context or application			
Solve			
Selects and applies effective solution procedures/techniques/tools correctly			
Solves math model using analytical, numerical, and/or approximate methods			
Verifies that the solution is practical and can be implemented			
Validates that the solution is appropriate and reasonably represents the original problem			

Appendix 3: Engineering Design Rubric

SO2: An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

Engineering Design: Engineering design is a process of devising a system, component, or process to meet desired needs and specifications within constraints. It is an iterative, creative, decision-making process in which the basic sciences, mathematics, and engineering sciences are applied to convert resources into solutions. Engineering design involves identifying opportunities, developing requirements, performing analysis and synthesis, generating multiple solutions, evaluating solutions against requirements, considering risks, and making trade- offs, for the purpose of obtaining a high-quality solution under the given circumstances. For illustrative purposes only, examples of possible constraints include accessibility, aesthetics, codes, constructability, cost, ergonomics, extensibility, functionality, interoperability, legal considerations, maintainability, manufacturability, marketability, policy, regulations, schedule, standards, sustainability, or usability.

Performance Dimensions	Does Not Meet Expectations	Meets Expectations	Exceeds Expectations
Design Considerations			
Asks design questions with respect to health, safety, welfare factors			
Asks design questions with respect to global, cultural, social factors			
Asks design questions with respect to environmental and economic factors			
Asks design questions with respect to codes and standards			
Identifies important design variables, documents specifications, establishes constraints, and considers implementation strategy to define solvable design space			
Design Process			
Demonstrates application of the steps of the engineering design process			
Develops clearly defined goals			
Gathers information and performs analysis and synthesis			
Includes steps of analysis, construction (if needed), testing, and evaluation as part of design project			
Formulates and documents more than one viable design to meet specified needs			
Evaluation			
Evaluates alternatives against requirements and considers risks and trade-offs			
Analyzes and ranks design possibilities to find "best" solution with consideration to the interdependency of the constraints			
Uses risk analysis to enumerate/respond to risks in product or process design			
Considers solution alternatives with respect to health, safety, welfare factors			
Considers solution alternatives with respect to global, cultural, social factors			
Considers solution alternatives with respect to environmental and economic factors			
Demonstrates use of design cycles more than once on a specified problem for refined result			
Design Solution and Documentation			
Fully conveys selection of final design and documentation			

Appendix 4: Oral Communication Rubric

SO3: An ability to communicate effectively with a range of audiences

Performance Dimensions	Does Not Meet Expectations	Meets Expectations	Exceeds Expectations
Delivery and Engagement			
The student dresses appropriately for the presentation.			
The student speaks loudly enough to be heard.			
The student avoids "ums," "uhs," or other filler words and unnecessary movements.			
The student maintains eye contact with the audience.			
The student does not read from the presentation.			
Technical Content			
The presentation is well-organized.			
The length of the presentation is appropriate for the setting.			
The student demonstrates technical knowledge.			
The student addresses questions well.			
The student uses technical vocabulary appropriate for the audience.			
Supporting Materials			
Correct spelling and grammar are used in the visual presentation			
Appropriate props, such as physical models or prototypes are used to support the presentation.			

Appendix 5: Written Communication Rubric

SO3: An ability to communicate effectively with a range of audiences

Performance Dimensions	Does Not Meet Expectations	Meets Expectations	Exceeds Expectations
Context and Purpose for Writing			
The technical content and level of detail are appropriate for audience			
The document provides a clear purpose and context and motivates the reader's interest in the topic			
Content Development			
The document addresses the stated objectives of the work			
The document is well-structured and organized with a logical progression from understanding of the problem or topic through research method, results, and conclusions			
All tables and figures or similar illustrations are referenced in the text			
Appendices are used effectively to provide supporting materials			
Sources and Evidence			
Statements are supported with a variety of credible sources: literature, experimental data, interviews, and/or other relevant sources, without plagiarism			
References are cited and presented in the format required			
Syntax and Mechanics			
The document has few to no grammatical, spelling, or punctuation, errors			
The document is readable, constructed from concise, clear, and correct use of language without jargon and slang			
The document has a consistent tense and voice			
All required formatting is followed, e.g., font, font size, margins			
Tables, figures, charts, graphics, drawings, photos, or similar visual methods communicate information effectively and are labeled well			
Appropriate units are used and are in the required format			
Math grammar is correct and appropriate			

Appendix 6: Ethics Rubric

SO4: An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

Performance Dimensions	Does Not Meet Expectations	Meets Expectations	Exceeds Expectations
Ethical Issue Recognition			
Identifies key ethical issues in engineering situations taken from real life, with outcomes both good and bad			
Identifies current or recent ethical cases and explains the main issues			
Explains engineering responsibility for the public health, safety, and welfare as stated in a relevant engineering code of ethics			
Understands conflict of interest and consequences of various actions			
Application of Ethical/Professional Perspectives and Contexts			
Makes balanced engineering judgments, i.e., selects alternatives and solutions, informed by appropriate codes, standards, breadth of information			
Assesses the economic impact of a solution, including identifying costs and benefits from a life-cycle perspective			
Assesses the societal impact of a solution, considering issues such job creation or elimination, disruption of lifestyle, culture			
Assesses the environmental impact of a solution, considering issues such as waste generation and pollution, sustainability, life-cycle design with respect to materials and energy			
Assesses the global impact of a solution, considering issues such as labor and material sources, laws and regulations, human rights, fair trade, geopolitical stability, culture, and language			
Conducts an appropriate safety analysis, i.e., considering hazards and safety concerns			

Appendix 7: Teamwork Rubric

SO5: An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

Performance Dimensions	Does Not Meet Expectations	Meets Expectations	Exceeds Expectations
Communication and Team Operation			
Communicates effectively with team members			
Attends regular scheduled team meetings			
Engages and participates as a team member			
Divides the workload fairly among the team			
Defines roles for each team member			
Works with team to define a decision-making process			
Project Management			
Uses project planning/scheduling methodologies and tools to manage the project			
Assigns and tracks project tasks and responsibilities			
Documents team meetings (including discussions and attendance)			
Maintains organized project documentation (electronically or project notebook)			

Appendix 8: Experimentation Rubric

SO6: An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

Performance Dimensions	Does Not Meet Expectations	Meets Expectations	Exceeds Expectations
Set-up			
Identifies appropriate test, data collection process, and data analysis model to conduct an experiment			
Describes and uses general measurement process or processes appropriate for the experiment			
References and uses appropriate standards for various test and experimental procedures			
Develops hypotheses or predictions of experimental outcomes to validate modeling assumptions and correctness of experimental methods			
Checks and/or calibrates the measurement system for appropriate calibration			
Sets up the experiment to ensure proper lab practice, operation, and general safety			
Uses dimensional analysis, appropriate dimensions, and units			
Data Collection			
Troubleshoots measurement systems for non-functioning components			
Uses appropriate instruments for collecting data			
Implements proper lab practice, operation, and general safety			
Maintains good technical notes of procedure and results			
Uses appropriate equipment, software and/or tools for data collection			
Analysis			
Uses appropriate statistical methods and measures to minimize experimental error			
Identifies and quantifies sources of uncertainty in the data or the analysis			
Validates data using other sources of information or related data			
Uses appropriate software and/or tools for analysis			
Summary and Conclusions			
Develops and supports conclusions and inferences with available data and analysis			
Compares experimental results to theoretical results and explains discrepancies			
Documents in an appropriate form so that the experiment can be properly replicated			

Appendix 9: New Knowledge and Learning Strategies

SO7: An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Performance Dimensions	Does Not Meet Expectations	Meets Expectations	Exceeds Expectations
Self-established Learning Goals			
Demonstrates analysis of prior learning for gaps in knowledge and skills			
Develops a plan to acquire new knowledge and skills			
Acquiring New Information			
Identifies the extent and type information needed for the problem or task at hand			
Independently conducts critical searches for references (literature and/or subject matter experts) to support/inform a topic			
Summarizes written/oral information for key concepts			
Demonstrates the ability to assess the credibility and applicability of information sources			
Learning Strategies			
Demonstrates awareness of different learning strategies			
Identifies personal strengths and weaknesses with respect to learning strategies			
Engages in professional learning experiences			
Applying New Information			
Demonstrates ability to use newly acquired information to solve engineering problem or apply to other engineering situation			